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Medicine

A STUDY ON ELECTROCARDIOGRAPHIC AND ECHOCARDIOGRAPHIC CHANGES IN CHRONIC KIDNEY DISEASE

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ABSTRACT **Background-** Patients with Chronic Kidney Disease exhibit an elevated cardiovascular risk manifesting as Coronary Artery Disease , heart failure, arrhythmias and sudden cardiac death. CKD causes a systemic, chronic pro-inflammatory state contributing to vascular and Myocardial remodeling processes resulting in atherosclerosis sclerotic lesions, vascular calcification as well as fibrosis and calcification of cardiac valves. In this respect, CKD mimics an accelerated aging of the cardiovascular system. **Procedure-** Total number of 80 cases including both male and female who presented With CKD in Postgraduate Department of General Medicine JLNMCH was taken in study. The duration of study is two years. Study design is hospital based observational prospective study. In inclusion criteria of cases with GFR 30 - 59 ml/min, bilaterally contracted kidney with poor CMD on USG. Patients with established CKD irrespective of etiology was taken into account. In all patients detailed history of illness, all blood biochemical investigations ECG, ECHO and USG were performed, and analysis was done accordingly. **Conclusion-** CKD is increasingly recognized as a global public health problem imposing huge medical and financial burden on society and Healthcare systems with an estimated prevalence of 13.4% globally. Control of traditional risk factors as well as antiplatelet therapy are cornerstones to reduce cardiovascular risks. The effect of lipid-lowering strategies on CV risk reduction in CKD seems to be dependent on severity of CKD (SHARP STUDY).

KEYWORDS : CKD, ECG, ECHO,LVSD,LVDD

INTRODUCTION

In health, the volume and composition of body fluids vary within narrow limits and kidneys are largely responsible for maintaining this state. They also subserve a host of metabolic and endocrine functions. The failure of renal function results ultimately in alterations of milieu interior that affects every organ system in the body. Chronic kidney disease (CKD) is defined according to KDIGO (Kidney Disease Improving Global Outcomes) 2012 guidelines as a functional or structural kidney abnormity, lasting for at least 3 months. CKD d according to etiology, glomerular filtration rate and/or albuminuria.

Chronic Kidney Disease is a clinical syndrome due to persistent renal dysfunction leading to excretory, metabolic and synthetic failure culminating in accumulation of non-protein nitrogenous substances and presents with varied clinical features. As soon as the cause for CKD is established, further evaluation is used to decrease the progression rate of the disease. In particular, evaluation of cardiovascular risk factors is critical, because of high rate of cardiovascular complications in CKD. Recent genetic background of hypertension is gaining importance in pathophysiology of hypertension. G protein coupled and calcium dependent kinase is responsible for control of blood pressure. Even lots of mutation can cause changes in the receptors, which in turn raise blood pressure disease.

It is important to note that no specific blood or urine test unequivocally differentiates acute from chronic kidney disease. Creatinine concentration in finger nail can establish chronicity but determination is not available in clinical practice. The most sensitive and specific test for establishing the chronicity of kidney disease is measurement of renal size. Currently renal ultrasonography is the technique of choice. The finding of small kidneys (<8cm) on renal ultrasonography is a reliable indicator of CKD. Renal biopsy is the most definitive method of differentiating acute from chronic kidney disease.

Easy fatigability, dyspnea, pedal edema, syncope, angina are the usual cardiovascular symptoms that are frequently encountered in patients with advanced renal failure. Structural and functional cardiovascular evaluation is done using X-Rays, Electrocardiography, Echocardiography and relevant blood Biochemistry test. There are several possible explanations for poor prognosis of CKD patients, including traditional cardiovascular risk factors (i.e., hypertension, diabetes mellitus, and dyslipidemia), nontraditional factors (e.g., malnutrition, inflammation, and oxidative stress), and CKD-related risk factors (e.g., atherosclerosis ,anemia, altered calcium phosphate metabolism).These factors may contribute to the development and deterioration of the coronary artery disease (CAD), micro-vasculopathy, valvulopathy, cardiomyopathy, and arrhythmias.

Cardiovascular disease accounts for about 50% of all deaths in Patients with CKD. Left Ventricular dysfunction is estimated to be present in 65% of such patients. All patients with mild to moderate Left Ventricular systolic dysfunction had normalization of heart function with renal replacement therapy. Patients of CKD having CVD had three to thirty times higher risk of mortality as compared to the general population.

MATERIAL AND METHODS -

AIMS AND OBJECTIVES –

1. To evaluate the ECG and echocardiographic findings of Chronic Kidney Disease at the time of diagnosis.
2. To know the prevalence of each echocardiographic changes in patients with Chronic Kidney Disease (CKD).
3. To study the Left Ventricular function, and its relationship with duration, symptomatology in patients with CKD.

Study Area: Postgraduate Department Of General Medicine Jawahar Lal Nehru Medical College & Hospital, Bhagalpur. **Study Population:** Admitted in postgraduate department of general medicine from Emergency and Medicine outdoor with CKD admitted were selected non-randomly for the study. **Study Period:** The duration of study was between September 2019 to January 2022. **Sample Size :** Total number of 80 cases including both male and female who presented with their CKD. **Sample Design:** Patients and their relatives were fully explained in their mother language about the study.

After getting proper informed consent from them, they were included in the study, if they fulfilled the following criteria: 1. Patients with GFR of 30-59 ml/min And/or Patients with bilateral contracted kidneys on abdominal ultra sound with poor cortical medullary differentiation. 2. Patients with established CKD irrespective of etiology. 3. Patients with known Valvular Heart disease, Coronary artery disease, Systemic Hypertension on regular treatment & patients with poor pulmonary function were excluded.

In all patients, detailed history of illness was taken with special reference to cardiovascular symptoms and subjected to a complete clinical examination. Blood biochemical investigations, ECG, Abdominal ultrasonography, complete hemogram were performed. Echocardiography was done in all patients by a single echo-cardiographist to minimize observer variation.

GFR was calculated using Cockcroft-Gault Formula In males-
GFR = 1.2 × (140-age in years) × weight in kg / creatinine concentration in μ mol/L
In females the multiplying factor is 0.85 instead of 1.2.

Systolic function - systolic function is assessed mainly based upon M-mode measurements of LV function. The ejection fraction is measured. Normal range 55-80% ,Mild systolic dysfunction 45-50% ,Moderate systolic dysfunction 35-45%,Severe systolic dysfunction <35% . **Diastolic function (Pulsed wave Doppler study)** Diastolic function is assessed by measuring mitral inflow , E/A measurements. E/V-in m/s. it indicates initial mitral flow which causes ventricular filling following the opening of mitral valve. A/V-in m/s. it indicates ventricular filling due to atrial systole. E/A-is usually >1. E/A<1 indicates diastolic dysfunction. Type I – Relaxation abnormality Type II – Pseudo normalization Type III – Restrictive abnormality. **Regurgitation (Color Flow Doppler Study)-mitral Regurgitation / Tricuspid Regurgitation-** When regurgitation jet extends Up to 1/3 of atrium : mild, 1/2 of atrium : moderate, Posterior wall of atrium: severe. Aortic regurgitation-Jet height / LVOT height- Mild: ratio less than 20, Moderate : 20-40,Severe : more than 40.

Pericardial Effusion-Uremia produces chronic pericardial effusions. The pericardial fluid is hemorrhagic. Echocardiography is the procedure of choice for the diagnosis of pericardial effusion. The diagnostic feature on M mode echo is the persistence of an echo free space between parietal and visceral pericardium throughout the cardiac cycle. 2 D Echo has superior spatial orientation and allows delineation of size and distribution of pericardial effusion.

They are described as small, moderate and large based on the size of echo free space between the parietal and visceral pericardium on 2 D Echo. Small: < 5 mm echo free space ,Moderate : 5 – 10 mm ,Large : > 10 mm. Fluid adjacent to the Right atrium is an early sign of pericardial effusion.

Statistics And Analysis -

Data Analysis-Data collected were analyzed by using taste like p value, analysis of variance and represented in the form of frequency tables, Bar diagram and Pie chart.

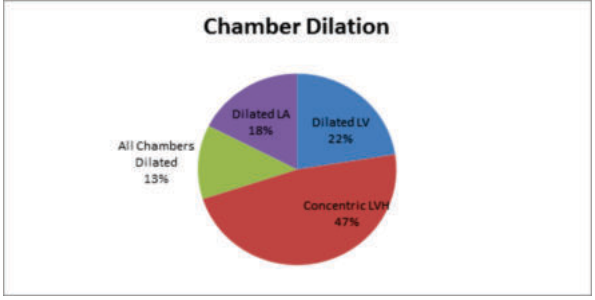
RESULTS- A total of 80 patients of CKD were studied in JLNMCH BHAGALPUR (BIHAR)to find out ECG and Echocardiographic changes in CKD. Most commonly affected age group was 41 to 50 years among them 57.5% male patients and 42.5% females. The age group most commonly affected is 41- 50 years with male predominance.

AGE IN YEARS	TOTAL		MALES		FEMALES	
	NO.	%	NO.	%	NO.	%
0-20	2	2.5%	-	-	2	2.5%
21-30	-	-	-	-	-	-
31-40	12	15%	6	7.5%	6	7.5%
41-50	28	35%	16	20%	12	15%
51-60	24	30%	12	15%	12	15%
> 60	14	17.5%	12	15%	2	2.5%

Echocardiographic Changes-

FINDING	NO. OF CASES	%
Dilated LV	18	22.5%
Concentric LVH	38	47.5%
All Chambers Dilated	10	12.5%
Dilated LA	14	17.5%

In 80 patients 18 patients developed Dilated LV which is 22.5% of total.47.5% developed concentric LVH and 17.5% developed dilated LA. All chambers dilated in 12.5% of the patients. Show most common echocardiographic finding associated with CKD in my study is concentric LVH with a(p-value of 0.907).



LV Function

GRADING	No	%
Mild	10	12.5%
Moderate	12	15.0%
Severe	0	0.0%

ECG Findings-

SL. NO.	FINDING	NO. OF PATIENTS	MEAN
1	LVH	50	62.5%
2	LVC	12	15.0%
3	ST-T Changes	24	30.0%
4	LBBB	2	2.5%
5	VPC	18	22.5%
6	Ischemia	48	60.0%

- In total 80 patients 62.5% of patients were developed LVH (p-value 0.189) finding in ECG,30% of them developed ST-T changes (p-value 0.130), 2.5% developed LBBB in ECG.60 % of patients were developed ischemic (p- value 0.004) findings in ECG. Show most commons ECG finding associated with ECG were LVH, Second most common is Ischemia.

In our study the average duration for cardiac disease to manifest in chronic kidney disease is 13-24 months.

S.No.	Etiology	No. of Cases
(i)	Chronic Glomerulonephritis	14
(ii)	Obstructive nephropathy	68
(iii)	Diabetic nephropathy	36
(iv)	Chronic interstitial nephritis	12
(v)	Autosomal dominant polycystic kidney ds	4

The commonest etiology in our study group is Diabetes Mellitus.

In this study, 76 patients have hemoglobin below 12gm% of which 20 patients have hemoglobin less than 8.0gm%.

Diastolic dysfunction-Type I – Diastolic dysfunction is present in about 50% of the cases. LV Contraction-Global LV hypokinesia is present in two cases. Pericardial Effusion- Pericardial effusion is present in 20% of cases.

	BP>140/90 N=5O	BP<14O/9O N=30	P VALUE
Echo Changes			
Dilated L.V Not Dilated	12 38	6 24	0.678
Conc LVH No Conc LVH	24 26	14 16	0.907
All Chambers Dil. Not Dilated	8 42	2 28	0.221
Dilated L.A Not Dilated LV	10 40	2 28	0.105
Pericardial Effusion No P. Effusion	14 36	2 28	0.020
ECG Changes			
ST-T Changes No Changes	18 32	6 24	0.130
LVH NoLVH	34 16	16 14	0.189
Ischemia No Ischemia	36 14	12 18	0.004
Duration Of Diesease			
13-24 Months Less Than Duration	16 34	10 20	0.901
LV Systolic Dysfunction No Dysfunction	14 36	8 22	0.897

DISCUSSION

Chronic renal failure is a constellation of signs and symptoms called uremia. It can present with features of involvement of any organ in the body. The present study is about cardiac involvement in CKD.

- Electrocardiogram showed evidence of LVH with or without Strain pattern in 62.5% of present cases. Ramegowda R (2018)[1] et al reported 48%. Low voltage complexes in 15% of cases.
- Occasional ventricular premature complexes in 22.5% of cases. Goornavar[2] was reported 16% in their study.
- Non-specific ST – T changes in 30% of cases.
- Ischemic Finding is consistent with Krivoshiev V[3] et al found 20% while Menon AS et al[4] found 29.1%, Goornavar et al [2] was reported

16% in their study. Sharma [6] et al was found 22% . Electrocardiogram will reveal the presence of LVH and previous ischemic events.

- More accurate assessment of LV function and hypertrophy requires echocardiography. Regarding cardiac arrhythmias, their episodic nature makes Identification and characterization difficult. Ideally 24 hours Holter[45] monitoring, serial 12 lead ECG are necessary to detect ECG changes and cardiac arrhythmias in CKD patients. Gleason et al[46] and Kimura et al[47] concluded that arrhythmias are due to acid base and electrolyte disturbances and underlying ischemic heart disease. Non sustained supraventricular tachyarrhythmias are common followed by ventricular premature complexes and ventricular tachycardia. Echo revealed cardiac abnormalities in all cases.
- **Chamber Dilatation-** 22.5% of Patients showed dilated LVH. 47.5% of Patients showed concentric LVH. In our study patients who have had long standing H/O Hypertension, show concentric LVH. The only major determinant of LVH in our study was the blood pressure burden. It is consistent with study of Menon et al[4] who reported 40% incidence . It correlates with the Harnett et al[9] study on impact of hypertension on cardiomyopathy, morbidity, mortality in ESRD. The concentric LVH includes Intra ventricular septal thickness in End Diastole. Anemia is an important determinant of End Diastolic Diameter.· In our study the average Hemoglobin level was relatively 6-7gm%.[63-] 68.LA enlargement was not a frequent finding in our study. It is thought to be due to diastolic dysfunction due to LVH.
- **LV Function-** Systolic dysfunction - 27.5% of cases· Diastolic dysfunction - 50% of cases. Sharma M et al[8] reported 52% of LVSD and 54% LVDD, a study conducted by Shivendra et al[6] reported LVDD in 51.42%patients and LVSD 28.57% in CKD. Agrwal S et al[7] reported LVDD in 53.2% patients and LVSD in 30% having LVSD . Factors contributing to development of CCF in patient with CKD are 1. Volume over load 2. Valvular heart disease 3. Negative inotropic effects of Calcium 4. Cardiac arrhythmias 5.Pressure overload 6.Myocardial damage 7.Anemia.
- **Pericardial Effusion-**· 20% of cases have pericardial effusion. Which is consistent with study by Shivendra et al[6] reported an incidence of 17.14% while Menon et al[4] who reported 32% incidence and Achari V et al[7] who reported 50% of pericardial effusion in CKD patients.

CONCLUSION

ECG and Echocardiography is an invaluable tool to asses the change in function and structure of the heart that result from chronic kidney disease and detecting early cardiac abnormalities in the patients that should be an integral part of assessment for renal transplant. 2-41-50 year males were the most common affected people in our study group.3-All patients were anemic.4-The most common etiology was Diabetes.5-LVH was the most common ECG finding noted.6-Echo detection of cardiac changes was present in all patients.7-Cardiac changes were more frequent in those who were in advanced stages of chronic renal failure reflecting a positive correlation of cardiac changes with the severity of chronic renal failure.8-Concentric LVH was the most common echocardiographically detected abnormality. Diastolic dysfunction was present in 50% of cases and systolic dysfunction in 27.5% of cases.

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